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NOTICE

The continued and increasing support of General Linguistics from individual and library subscriptions has enabled the editors to increase the nominal payment made to contributors to ten dollars for articles, five dollars for notes, beginning with the present issue. Some improvement in printing methods is also anticipated.

SERBO-CROATIAN STRESS AND PITCH

Carleton T. Hodge
Foreign Service Institute

1. Description[1]

1.1 Stress and pitch phonemes. There are three degrees of stress in Serbo-Croatian: weak (here unmarked), secondary /ˆ/ and primary /ˊ/. There are four pitch phonemes: low /1/, mid /2/, high /3/ and extra-high /4/. Each utterance consists of one or more phonemic phrases. Each such phrase contains at least one primary stress (but no more than two - see below) and terminates in one of three junctures: /|/, /‖/ or /#/. Secondary and weak syllables occur only in conjunction with primary stress within a phrase. Occurrences of primary stress may be noted as follows: (Pitch in the examples given is indicated at the beginning of the syllable involved or at onset within a long (double) vowel.)

1)	Singly on a short vowel	/^{3}né^{2}#/
2)	Singly on the first of geminate vowels (i.e. on the first part of a phonetically long vowel)	/^{2}da ^{3}plá ^{1}atiim#/ 'that I pay' (i.e. 'bill, please')
3)	Double, on a) two short vowels occurring in successive syllables b) on a short vowel and the first of geminates in the following syllable	a) /^{2}ko^{3}líkó ^{1}su#/ 'how much are they?' b) /^{2}ra^{3}zúmé^{1}em / 'I understand'
4)	Double, on the second of geminate vowels and a) the (short) vowel of the following syllable b) the first of geminates in the following syllable.	a) /^{2}razume^{3}été^{1}li#/ 'do you understand' b) /^{2}sa^{3}áti^{1}i#/ 'of hours'
5)	Singly on the second of geminate vowels, where the following syllable contains a single vowel followed by/#/. This replaces 4a), under these conditions, with some speakers.	/^{2}hva^{3}á^{1}la#/

The sequence /áa/ (2) indicates an intensity followed by a sharp lessening of the intensity within the long vowel. In the sequence /aá/ (4 and 5) there is increasing intensity. In /á-á/ and /aá-á/ the second of the two primaries may have a higher

pitch than the first, but the first has greater intensity.

The occurrence of a single primary stress is frequent on the first syllable of a word or stress unit. It also occurs, optionally, in the sequence #CV#, as above. It is otherwise rare in positions other than the first syllable, though examples are found, particularly in recent loans.

Secondary stress occurs:

1) on single vowels — /^{2}žèlim da ^{3}jé^{1}deem#/ 'I want to eat'

2) on geminates — /^{2}tòò je ^{3}jéf^{1}tino#/ 'that's cheap'

It occurs only on a single syllable in a given word or stress group.

The occurrence of geminate vowels is directly related to stress. Geminates occur with primary stress on either member and may occur in post-primary stress syllables. They also occur under secondary stress. They do not occur preceding primary or secondary or after secondary stress in a word or stress unit. Compare: /^{2}žèlim da ^{3}jé^{1}deem#/ in one phrase, with secondary on /žèlim/ and /^{3}žé^{2}liim | ^{2}da jé^{1}deem#/ in two phrases, with primary on /žéliim/. A word with primary stress has the maximum differentiation of stress and vowel length. This is reduced under secondary stress. The analysis here puts secondary stress on both vowels of geminates: /tòò/. Phonetically this is a long, secondary stressed, vowel. It could also be analyzed as a single secondary /tòo/. This is avoided as possibly implying a parallelism of /tòo/ with /tóo/, the latter decreasing in stress. The characteristic stress crescendo of /aá/ and decrescendo of /áa/ is not found with secondary stress.[2]

1.2 Stress units. While the phenomenon of the open, 'plus', juncture, as contrasted to close juncture, has not been investigated for Serbo-Croatian, it is obvious that a great many groups normally separated by space in the orthography are units containing but a single primary or secondary stress and probably in close juncture (undoubtedly so in most cases). This is true not only of groups containing what have been known as 'proclitics' and 'enclitics' but also of words capable of separate stress but sometimes compounded in colloquial speech. Proclitics include the negative /ne/ and a number

of prepositions, e.g. /né znaam/ 'I don't know', /sá mnoom/ 'with me', /kód kućee/ 'at home'. These are all phonemic words. (Examples have been chosen with stress on the proclitic; many proclitic prepositions do not have the stress or have it only under certain conditions.) A double primary may carry over onto the noun: /ú gráadu/ 'in the city'; contrast /ván graada/ 'outside the city'.

Enclitics include the question particle /li/, stressless forms of 'to be' (except /je/) and 'will', short accusative pronouns, short dative pronouns and stressless /je/ 'is' in that order. For example, /jáa sam/ 'I am', /dá li su/ 'are they'. In some cases a single primary stress on a monosyllable is replaced by a double when an enclitic is added: /štá/ 'what' but /štá ćéte/ 'what will you'.

'Enclitic' and 'proclitic' are thus terms used to overcome the vagaries of the orthography. It would be worthwhile to make a spectrographic analysis to help fix the position of the open juncture. The orthography may in some cases have some linguistic truth behind it.

Proclitics and enclitics are well known and often described. The compounding of what are usually treated as separately stressed words is therefore more interesting. Examples are: /^{3}štá žé^{2}lii|^{2}gó^{1}spodja#/ 'what does the madame wish?'. /^{3}štá tré^{2}baa| ^{3}jóš^{2}| ^{2}da ^{2}úrá^{1}adiim#/ 'what else do I have to do?'. /^{3}kó plá^{2}aćaa| ^{2}osigura^{2}á^{1}nje#/ 'who pays for the insurance?'. /^{3}dá ^{2}li su njive ^{3}dóbró ^{1}obraadjene#/ 'are the fields well cultivated?' (/dóbróbraadjene/). In each of these examples the second member of the compound would replace a long vowel by a short were it said as a separate word under secondary stress: /štá žèli/, /štá trèba/, /kó plàáća/, /dóbró òbradjene/.

The familiar superlative 'prefix' is normally a separate phonemic word (though normally written together with the following word), both it and the following adjective or adverb having one primary, the other secondary, stress. For example: /náaj vìše/ 'most'. Compounds with this morpheme are also found: /náajvišee/, /náajvećaa/ 'largest'. Note that the long vowel appears in the adjective when the group is one phonemic

word..

1.3 Contours. Following Trager, the pitch contours are given as three number sequences, the next to the last number in a contour indicating the pitch coincident with the primary stress.[3] For example, the sentence /²dȍbar ³dá¹an#/ 'good day' has the contour /2 3 1/, with the /3/ coincident with the primary stress. Such a system necessitates the writing of two identical numbers in sequence in many contours, such as /2 2 1/, where the pitch is /2/ until the final drop, but the second /2/ must be there to show that the primary stress is on /2/, not /1/. Primary stress may be anywhere within the phrase. Compare /²kȍd ³kȏ¹gaa ste kȕûpili šťȍf#/ 'where ('at whose') did you buy the material?' and /²u jȅdnom vȅlikom magazi³í¹nu#/ 'in a large store'. Obviously any three point contour is reduced to two (the last two) if the primary stress of the phrase is on the first vowel of the phrase: /³gdé ²je| ²stá¹nica#/ 'where's the station?'. Here both phrases have only two pitch phonemes, /3 2|2 1/ for /2 3 2|2 2 1/. Contours of more than three pitch points have not been noted to date, but this does not exclude the possibility, or even probability, of their existence.

A single phrase utterance ending in /#/ most commonly has a /2 3 1/ contour: /²dȍbro ³jú¹tro#/ 'good morning' (more colloquially /²do³brój¹tro#/). /2 4 1/ is contrastive: /³né¹# ²hȍtel ⁴ní¹je na lȅèvo#/ 'no, the hotel is not on the left'. The use of pitch /4/ is very common in ordinary conversation. Examples of other contours are: /²do vidje³énjá ¹tȍomo#²do vidje²énjá ¹zȍȍro#/ 'Goodbye, Tom. - Goodbye, Zora'. /²hva²á¹la#/ 'thank you' (also /²hva³á¹la#/, of course). Before /‖/ the contour is /2 3 3/ when the primary stress is within two syllables of the end of the phrase: /²a trpe³zárí³ja‖/ 'and the dining room?' The /‖/ juncture is used more frequently in non-final position (see below). Its use in final position as part of a 'question' intonation is limited, as most Serbo-Croatian 'questions' have question words or particles and /2 3 1/ or comparable pitch patterns.

Sequences of two or more phrases most frequently have /2 3 2/ for the non-final phrases and /2 2 1/ for the final phrases. (An utterance may, of course, 'break off' with a non-final phrase contour and juncture.) The phrases may be short:

/2re3stórá2an je 2na 2dé1sno#/ 'the restaurant is on the right', or long: /2vàši srednjevèèkovni mànastiri i cr̀rkve su 3dí2 ivnii| 2kùlturni 2spó1menici zòòro#/ 'your medieval monasteries and churches are wonderful cultural monuments, Zora'. There may be a series of non-final phrases: /2sàmo požu3úrí2 te| 2jèr mòòramo svra3áti2ti | 2i u 2pródá1avnicu#/ 'only hurry, as we have to go the store,too'. /2dààjte mi dvèè kìle bèèlog 3brá2šna| 2kìlo 3píŕi2inča| 2pèèt kìlograma 3šéćé2ra| 2jèdan kìlogram 3ká2fee| 2i dvèè vèlike čokola2á1de#/ 'give me two kilograms of white flour, a kilogram of rice, five kilograms of sugar, a kilogram of coffee and two large chocolate bars'. The substitution of /3/ for the /2/ coincident with the primary stress in a /2 2 1#/ contour ending a series is emphatic: /2i 3méní 2se tàko čini| 2ima 3mnó1go svèèta#/ 'it seems so to me, too; there are a lot of people!'. /3á2a| 2òvo je 3Ní 1iš#/ 'oh, this is Nish!'.

Some sequences have /2 2 1/ contours within the series. Such a series could be made into two (or more) sentences by substituting /2 2 1#/ for /2 2 1|/. Examples with /2 2 1|/ are: /2a3sád 2ste| 2u Be2ógrá1du| 2pre3ésto2nici| 2Jugo2slávi1jee#/ 'and now you're in Belgrade, the capital of Yugoslavia'. /3póglé2daajte| 2òvo 2di1ivno gròòždje| 2pà brèskve i 3jábú 2ke| 2da ne gòvorim o 2krú1škama#/ 'look at these wonderful grapes, and the peaches and apples, not to speak of the pears!'. The /2 2 1l/ contour is usual before /zàr né/ n'est-ce pas': /2àli ste 3sí2guurno bìili 2u 2Sárá1 jeevu| 2zàr 3né1#/ 'but you have surely been in Sarajevo, haven't you?'. /2vii ste zèmlja vèlikih plani 3iná2a| 2i 2šú1umaa| 2zàr 3né1#/. 'You are a country of huge mountains and forests, aren't you?'. Note the contrastive /3/ on /né/.

Some of the other sequences of pitch contours noted were: /(2) 3 2 | 3 1 1/ - /3mó2liim | 3štà želi 1i1te#/ 'what do you want, please?'. /(2) 3 2 | 2 1 1/ - /3kákáv 2je | 2kva1lite1et#/ 'how is the quality?'. /2 3 1 | 1 1 1/ - /2dòbar 3dá1an | 1gòspodjo Jova1áno1vić#/ 'good day, Mrs. Jovanović'.

When the second of two primaries occurs immediately before /|/, the pitch contour is /2 3 3/ rather than /2 3 2/: /2hòćete li bìti pòsle po3ódné3 | 2kód 1kućee#/ 'will you be home in the afternoon?'. /2pake3été3| 2za ino3stránstvó3|

2prìȉmamo 3sá2mo | 2àko imààte 3spé2cijaalno odobrèènje 2mini3stárstvá3 | 2tr2góvi1nee#/ 'we accept packages for other countries only if you have a special permit from the Ministry of Commerce'. (The final /3/ of the /2 3 3/, as well as the repetition of /1/ in /1 1 1/ and the like, is added to maintain the pattern of the second pitch number from the end coinciding with the primary stress. This is of course Trager's device.)

The contours /2 3 2/ and /2 3 1/ are replaced by /2 3 3/ before /‖/ if no more than one syllable follows the primary stress: /2a 3zó3ora / 'and Zora?'. /3ánti3mon‖ 3ni3kl‖ 3zlá3ato‖ 3sré3bro‖ 3ú3galj‖ 2i 3tá2ko| 2dá1lje#/ 'antimony, nickel, gold, silver, coal, etc.'. /2jàà ću vam skrèènuti pa3 ážnjú3‖2na sààbornu 3cr3rkvu‖ 2univer3zíte2et| 2i nàà rodnu 2skúp1štinu#/ 'I'd like to call your attention to the orthodox cathedral, the university and the National Assembly'. Examples abstracted from sentences are: /2slučaje3vá3a‖/ 'of cases', /3grá3adjee‖/ 'of building material', /2Jàblanicu na 3Néré3tvi‖ 2Zvòrnik na Dri3ní3 / 'Jablanica on the Neretva, Zvornik on the Drina,'.

The following sentence shows the interchangability of /\/ and /‖/ and the resulting changes in the contours.

/2mòžete dòbiti bèèlu kàfu ili 3čáj2 | 3pútér3 | 2marmalá3 adu3| 2ròvita ja3ájá3 | 2kàjganu sa 3sláni2noom| 2ìli sa 2šu1unkoom#/

/2mòžete dòbiti bèèlu 3káfú3‖ 2ìli 3čáj3‖ 3pútér3‖ 2marmalá3ádu3‖ 2ròvita ja3ájá3‖ 2kàjganu sa 3sláni3noom‖ 2ili sa 2šú1unkoom#/

'We have café au lait or tea, butter, marmalade, soft-boiled eggs scrambled eggs with bacon or with ham'.

2. Comparison with Earlier Statements.

In 1851 Djuro Daničić published the first of a series of articles on Serbian accent. His main concern was to state the distribution of the accent, but he prefaced this with a brief statement on the nature of the accents. This read as follows:

"There are four accents in the Serbian language: for example, the first a in the word glava is pronounced one way,

another way in pravda, another in magla, another in slama. Of these four accents the first two are long, but the second two short; the first is indicated thus ´, the second thus ̑, the third thus ̀, but the fourth has up to now been indicated rather haphazardly: it has been indicated just like the third, except in a few words, which are distinguished one from another only by these acdents, as e.g. jarica: this word means the wheat sown in spring when the first a in it is pronounced as the first a in the word magla, but it means a young goat when the first ā in it is pronounced as the first a in the word slama. In these words this fourth accent has been indicated thus ̏. I will so indicate it in the following![4] Here was the beginning of the consistent noting of the four accents. This article was followed the next year by the second edition of Vuk's dictionary (1852), which was the first to mark the entries with this consistent four point notation. The accentuation of the words in this edition is attributed to Daničić.[5]

These four accents are 1) short fall (̏), 2) short rise (̀), 3) long fall (̑) and 4) long rise (´). They correspond to the notation in our description above as follows: ̏ is /á/, ̀ is /á-á/, ̑ is /áa/, ´ is /aá-á/ or /aá-a#/. In addition ̑ was used to indicate long vowels following an accented syllable. In the case of the sequence ̀̑ on successive vowels this was accurate, if slightly redundant: razùmêm = /razúméem/ (ù-e = /ú-é/, ê = /ée/). The same would be true of ´̑ (= /aá-áa/). Later usage has tended to use a macron for long vowels following the accent (that is, following the accent notation since the macron in razùmēm is on a vowel which has the second of two primaries).[6]

Daničić's work was based on that of Vuk Stefanović Karadžić, and it is to his Serbian Grammar, which formed part of the introduction to the first edition of his famous dictionary (1818), that we turn for the earlier history.[7] Here Vuk stated that there were four accents noted by ̀ ´ ̑ ^. It is noted that there are two pronunciations included under ̀ and that ̏ may be used for one of them. The use of ^ is curious, being used where the later notation is ´ or ̑ (both long falling accent and post-accent length).

Another use of accent marks is made by Froehlich in his grammar (1850).[8] He distinguishes short (̀), long sharp (´)

and long turned about (^). The long sharp is long falling, described by him with double vowels: á as àa, é as èe, etc. (our /áa/, /ée/). The long turned about is long rising, described again in double vowels: â as aà, etc. (our /aá(-á)/). Some of his examples cannot be long rises, as they are monosyllables. The examples in the rest of the book rarely have accents, so a real system cannot be seen. His ´ is sometimes used for post-accent length (e.g. on pp. 36-37).

The use of double vowels to illustrate the nature of the Serbo-Croatian accent is found in a number of other works, many of them early. Mažuranić explains /ruúká/ as ruùka[9], Jagić compares ekavski béla, snêg with jekavski bijèla, snijeg and é as eè and ê as èe.[10] These double vowel notations are of particular interest to the phonemicist, as they come very close to the phonemic statement (see Description). They are, however, only attempts to give the phonetic facts, while the accents remain as the equivalent of what we now call stress phonemes. Further, the carry-over into the following syllable is not realized in these works. In fact the short rises are explained with double vowels, to indicate the rise within the short vowel.[11] A clear statement of the carry-over is made by Appel: 'Das Wort vòda (3) ist ein Musterbeispiel für kurze steigende Betonung. Das Ansteigen der Tonhöhe in betonten o findet im folgenden a seine Fortsetzung. Das a ist an der steigenden Betonung mitbeteiligt und bildet einen Vergleichspunkt für den Verlauf der Tonhöhe im Worte voda. Erst wahrend des Ausklingens des a im Nachhauch fällt die Tonhöhe.'[12]

The four accent pattern seen a bit hazily by Vuk but clearly stated in 1851 by Daničić, has remained standard to this day. Stevanović's grammar (1951) may be fittingly chosen as a hundred year mark in its 'official' use.[13] While Stevanović has an introductory paragraph on 'sentence accent', this is not elaborated or used textually. His exposition is the classic one describing the four accents in terms of stress and pitch.

This is not to say that much valuable work has not been done. A great deal of work, particularly on the phonetic level, has appeared. An interesting treatment is that of Fry and Kostić. They note that 'The extra long vowel, in unemphatic forms, and under the influence of sentence intonation, often

loses the characteristic rise-fall and in this case it is the length which is the important feature.'[14] They also note that there are 'weak' and 'strong' stresses. They unfortunately compare these with ` (as weak) and ´ (as strong). Nevertheless, their work is provocative, though still falling short of what was needed to replace the traditional view successfully. A recent treatment from the acoustic phonetic point of view, that of Appel, is interesting because of the correlation of what would be a phonemic interpretation with some of the acoustic data given there.[15] For example, the following two sentences which he gives to illustrate 'Melodiekurven' may be re-interpreted phonemically: His vidio sam put ali nisam pošo was probably said: /^{3}vídi^{2}o sam pùut | ^{2}ali ni ^{3}ísám^{3} | ^{2}pó^{1}šo#/ and dva su bora uporedo rasla to be read /^{2}dvàà su^{3}bó^{2}ra| ^{2}úporedo ra^{1}asla#/.

It should be stressed at this point that in words spoken in isolation there is one to one correspondence between the Danicic system of 1851 and that proposed here, with the exception of point 5) in 1.1. Most of the work done since then has clarified the phonetic nature of the accents and has pointed up the necessity for a distinction between the 'sentence accent' and the others. The fact that a clearcut description has not hitherto been made may be ascribed to several causes: 1) failure to separate stress and pitch phonemically. The fact that both are involved is always stated in any real description. On the other hand, attempts have been made to separate the accents which are primarily stress (falling) from those which are pitch (rising). Such a procedure is doomed to failure. Another approach is that of Belic who carefully separates the description of the pitch from the description of the stress but assigns both these phenomena to the traditional accent.[16]

2) failure to recognize the phonemic identity of the primary stress in its five distributional positions. Here those who used double vowel notations came the closest to the truth.

3) failure to recognize that secondary stress was a different type of phenomenon. Despite careful observation and the evidence of acoustic phonetics, there is constant insistence that the accents of each accented word in the sentence are of the nature here ascribed only to primaries.[17] It may be that part of

this insistence may be due to dialects in which it is true, but my observations of the standard language lead me to believe it is not true of that dialect, which is our major concern.

The preceding is not a history of the investigation of the Serbo-Croatian stress and pitch phenomena. Its purpose is to point up some of the high lights in order that the reader may have a clearer idea of what this paper hopes to contribute. This may be summarized as follows:

3. Summary Argument

1. Serbo-Croatian stress and pitch are phonemically distinct.

2. There are three degrees of stress: weak, secondary and primary.

3. Primary stress may occur singly and doubly (on successive vowels in consecutive syllables). Words or stress groups containing primary stress may have post-stress long (double) vowels.

4. Secondary stress occurs on short or long vowels. Words or stress groups having a secondary stress have phonemically long vowels only in the stressed syllable.

5. Pitch phonemes occur in patterned sequences. The allophones of the pitch phonemes are conditioned by the concurrent stress pattern. The pitch pattern morphemes have allomorphs determined by juncture.

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1. An earlier version of this paper was given as a paper at the 1952 Kentucky Foreign Language Conference. The analysis is based primarily on a speaker from Shabac, Mr. Janko Jankovic. The data correlates with other observations made, both speakers and published materials (see Part 2). The interested reader may listen to the records which accompany C. T. Hodge, Spoken Serbo-Croatian, New York 1945. That text did not distinguish between occurrences of single and double primary on short vowels, though they may be clearly heard on the records. The latter give a western Serbian speech. The present analysis underlies the notation used in the Foreign Service Institute Spoken Serbo-Croatian (prepared by C. T. Hodge, C. E. Bidwell and Janko Jankovic).

Ordinary Latin spelling is used for the examples, with the substitution of dj for đ, for convenience, and the use of double vowels for length. A phonemic notation would use /ər/ and /ərə/ for /r/ and /rr/. Compare the use of /ə/ as a phoneme in the (Serbian) names of the letters: /bə/ /və/, /gə/ and in some letter abbreviations (comparable to our NRA, etc.). Cyrillic is transcribed into Latin letters in the bibliographic titles and quotations from Serbo-Croatian works translated.

2. The qualitative difference between primary and secondary stress was pointed out to me by Professor George L. Trager. Following this lead the present analysis was evolved. Compare the quotation from Fry and Kostić below.
3. Unlike Trager's usage, the final pitch is given at onset rather than at the end of the phrase. This has no phonemic significance.
4. Djuro Daničić, 'Nešto o srpskijem akcentima', Slavische Bibliothek, Vienna, 1851, reprinted in Djuro Daničić, Srpski akcenti, Belgrade-Zemun, 1925. Quotation from reprint, page 1.
5. A. Belić, article 'Karadžić' in St. Stanojević, Narodna Enciklopedija Srpsko-Hrvatsko-Slovenačka, Zagreb, 1929, Vol. 2, page 2436.
6. Belić uses a macron in recent works, such as his Savremeni srpskohrvatski književni jezik, Prvi deo: Glasovi i Akcenat, 2nd ed., Belgrade, 1951 and his Pravopis srpskohrvatskog književnog jezika, Revised Edition, Belgrade, 1950, though in the latter he also uses a special symbol (^) for the long vowel of the genitive plural. Milan Rešetar, Elementar - Grammatik der kroatischen (Serbischen) Sprache, Zagreb, 1922, used ¯ for the accent and ^ for the post-accent length (see pages 15-16). The use of the macron goes back to at least the same time, being found, for example in J. Lukić, Glasovi srpskoga jezika, Belgrade, 1923, A. Meillet and A. Vaillant, Grammaire de la langue serbocroate, Paris 1924 (see page 25) and Josef Ivanić, Serbokroatische Sprachlehre, Vienna, 1926 (see page 22).
7. Vuk's earlier work, Pismenica serbskoga jezika, Vienna 1814, I have not seen, but it reportedly did not include the accent ˋ (see Ivan Šajković Die Betonung in der Umgangssprache der gebildeten im Königreich Serbien, Leipzig, 1901 p. 12). As the 1818 edition of the dictionary

was also not available to me, I have relied on the 1894 reprint of the grammar in Skupljeni gramatički i polemički spisi Vuka Stef. Karadžića, Vol. 2, Belgrade 1894 pp. 27-87 and on Jacob Grimm's translation, Wuk's Stephanowitsch kleine serbische grammatik, verdeutscht und mit einer Vorrede von J. G., Leipzig and Berlin, 1824.

8. R. A. Froehlich, Theoretisch - praktische Grammatik der ilirischen Sprache, Vienna, 1850, pp. 11-12.
9. Data from Šajković, op. cit. p. 21. Šajković is valuable for his survey of earlier work, as well as his bibliography.
10. In an article in Rad 13 (1870) precise reference not at hand.
11. See A. Leskien, Grammatik der serbo-kroatischen Sprache, Heidelberg 1914 pp. 123-124, for examples of this.
12. W. Appel, 'Gestaltstudien, A. Untersuchungen über den Akzent in der serbokroatischen Sprache' Wiener Slavistisches Jahrbuch Vol 1 (1950), p. 59.
13. M. Stevanović, Gramatika srpskohrvatskog jezika, Belgrade, 1951, pp. 70-74. The concept of 'sentence accent' is used by many writers.
14. Dennis Fry and Đorđe Kostić, A Serbo-Croat Phonetic Reader, London, 1939, p. 8.
15. Appel, op. cit. pp. 58-59.
16. Aleksandar Belić, Savremeni srpskohrvatski književni jezik, pp. 114ff.
17. A. Belić, Oko našeg književnog jezika, Belgrade 1951, p.33, states this categorically: 'I must naturally mention that the accents in Serbo-Croatian are kept unchanged in a sentence; neither prose nor poetic style changes their values. They may be left out in certain cases, but they may not be pronounced in a different way.' Cf. Ivan Brabec, Mate Hraste and Sreten Živković, Gramatika hrvatskog ili srpskog jezika, 2nd ed. Zagreb, 1954, p. 17: 'The sentence accent does not change the nature of the accent of the word itself'.

SOME MINOR COMPOUND TYPES IN GERMANIC

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In the early stages of the Germanic languages composition, as a morphologic process, was not notably extended.[1] If we compare the early Germanic languages with Classical Sanskrit or Homeric Greek (for example), we find that composition was not nearly so productive a process in Germanic as it was in Sanskrit and Greek. Nevertheless, the early Germanic languages possessed a sizeable stock of compounds. Some of these were inherited from the Proto-language, as is made clear from the fact that cognate compounds exist among the early Germanic languages: e.g. the determinative compound meaning 'pressing need' appears in cognate forms distributed throughout most of the early Germanic languages; viz. Go. naudiþaurfts OHG nôtduruft, OLG nôdthurft, OFris. nêdthreft, OE niedearf, OSwed. nödtharf.[2] Many of the early Germanic cognate compounds are not so widely distributed, but the distribution and forms are of such a nature as to rule out independent innovation or borrowing. Such is the case with the compound meaning 'window', which has the following cognates: Go. augadauro, OHG ougatora, OE ēagduru.[3] Frequently, also, compounds with cognates in West and North Germanic may be reckoned as descending from a Proto-Germanic form, the nature of the Gothic remains accounting for the non-existence of the East Germanic counterpart. In addition to the common inherited stock, we may be sure that a certain amount of innovation took place independently in the early Germanic languages. This question will be dealt with later.

In the history of the Germanic languages certain factors operated to reduce the stock of compounds. One of the major developments of this kind is the transition of certain compound-entering stems from the status of independent words to that of suffixes.[4] This process, which was probably induced by the Germanic fixing of the accent on the prior stem, involves the loss of affinity between such compound-entering stems and their simplexes or deriving forms. In this way, second members like OE -dōm, with the original meaning 'fame, honor' (PDE -dom, PDG -tum), OE -hād 'position, character' (PDE

-hood, PDG -heit), and OE -scipe cf. OE scieppan, Go. skapjan. 'to create' (PDE -ship, PDG -schaft) underwent a shift in meaning. This shift is from the lexical to the grammatical plane of meaning and, while certain relationships between free morphemes and bound morphemes may be of interest in the synchronic analysis of a language's morphology, the shift from one of these planes of meaning to the other is a diachronic problem--and one of a certain importance since, in the history of a language, when a morpheme shifts its meaning in this direction, compounds become non-compounds. On the descriptive level it is a matter of distribution: if a joined form (joined on the basis of prosodic criteria) either occurs as or is phonetic-semantically associated with a free form, its status in the complex form is--member of a compound; if the joined form is not so distributed, its status is affix.

Certain sound-changes, which obscured the original morphological composition of forms, also reduced the number of compounds in the Germanic languages: cf. OE nicumen 'newly arrived', simplex niwe; OHG wurzala 'root' as against OE wyrtwalu, originally 'plant stock' or the like.

To be sure, the great majority of compounds in present-day English and German--languages rich in compounds--have arisen since these languages have been put to literary and other specialized uses. However, just as there were, in the earlier stages of Germanic, mechanical factors which led to a decrease in composition, so were there mechanical factors leading to an increase in composition. The same accent shift which caused second members of compounds to be reduced to the status of suffixes entailed, also, the phonemic reduction of the inherited suffixes to a point where their sememic (or grammatical) force was weakened or lost; compounds were developed to make up this loss: cf. PDG Fährmann, OHG ferio 'ferryman', and the PDG Ferge (obs. or poet. 'ferryman'). Another mechanical factor which led to the increase of composition was the fixing, in the Middle Ages, of the word-order. This development, which resulted in repeated collocation of the same forms, also led to the formation of new compounds.[5] The fact is, however, that composition in the Germanic languages has enjoyed its greatest increase in the latter-day stages of these languages--through new formations in poetry,

journalism, and technical writing.

Of the inherited Indo-European compound types, the major types--bahuvrīhi, tatpuruṣa karmadhāraya--are well-represented in the earliest recorded Germanic languages. Here, however, the distribution, in Germanic, of some of the minor compound types will be taken up: we will consider the dvandva, āmreḍita, and dvigu types. Of these three types, only the dvigu is well-represented; the other two types are almost non-existent in the earliest stages of the Germanic languages.

Dvandva, or copulative, are those compounds whose members stand to each other in a relation of coordination. The members of such compounds are coordinately head-members. The German compound schwarz-weiss and the English compound blue-black illustrate the difference; only the former is coordinate.

Wackernagel has discussed the dvandva as follows:[6] a coordinate group grows together from the repeated use of the two elements as a regular sequence: e.g. the names of two gods, as Av. Ahura-mithra. In the earlier stages of these compounds in Indic, each member has its own accentuation and the prior member is in a case-form, usually in the dual number. Later, the accent becomes restricted to the latter member, although the prior member is still inflected. Finally, the prior member is found in the stem form. At this point the process of composition has been completed, and the last trace of its origin has been effaced. Brugmann states that the dvandvas became used with the prior member in stem form on the model of the subordinate compounds which showed this type of formation from earlier times. He cites *duō-dekm (two+ ten), *duō showing the dual ending, as representing the Proto-Indo-European type.[7]

In Germanic the dvandva type is not very widely distributed. In fact, of the inherited Indo-European compound types, it is the first to die out.[8] No examples of this type are recorded in either Gothic, Old Norse, or Old Frisian; Wulfila resolved the two dvandvas of the Greek Bible into phrases.[9] Aside from the numerals, which will be taken up later, Germanic offers only four old dvandva compounds: OS gisunfader 'son and father', OE suhtergefæderan 'nephew and uncle' and aþumswerian 'son-

in-law and father-in-law', and OHG sunufatarungo. The last compound is usually read as 'the followers of the son and father', -ungo being regarded as a kind of patronymic suffix. It should be noted that in three of these compounds an affix is added: the particle ge- in two cases and the suffix -ungo in one. There is also something irregular about the fourth example.[10] It has been suggested that these additions were made in order to weld together the compounding stems.[11] This would indicate that the dvandva type was no longer completely understood in this early stage of the Germanic languages.

There is a fairly good-sized class of compounds in the early Germanic languages which resembles the dvandva but which is not considered dvandva. This class, which Kluge refers to simply as 'eine auffällige Zusammensetzung zweier Substantiva',[12] comprises compounds of the type OE winedryhten (composed of the elements for 'friend' and 'lord') and, with adjectives, ON blâhvîtr (composed of the elements for 'blue' and 'white'). These are considered determinative compounds and are construed as meaning, respectively, 'friendly lord' and 'bluish-white'.[13] The dvandva type is highly developed only in Indo-Iranian; Germanic shows very few remains.

Another type of compound which is almost non-existent in Germanic but which has some historical importance is the type called by the Hindo grammarians āmreḍita; this is Bloomfield's repetitive type. This type, which has a significant development only in Sanskrit, is characterized, formally, by the repetition of two identical inflected forms, of which only the former carries the accent.[14] The meaning of these compounds is primarily iterative. They imply repeated or continual action: e.g. Ved. dyávi-dyavi, 'from day to day'. Often a compound of this type grades off into a distributive sense, as in the case of Skt. pū́rvas-pūrvas, 'each time the earlier'.[15] Some āmreḍitas seem to waver between the iterative and distributive senses. Thus, Ved. dáme-dame has been construed in the iterative sense to mean 'in one house after the other' and, in the distributive sense, to mean 'in every house'.[16]

Many repetitive compounds are, in fact, not reckoned āmreḍita. Compounds, for example, whose repetition is made for onomatopoetic reasons are not āmreḍita.[17] Thus, a form

like PDE choo-choo is not an āmreḍita in the accepted sense of the type. The OHG forms murmurôn, murmulôn, 'to murmur' also come under this variant type.[18] Further, if the process of 'Worteinung' happens to affect a construction so that the same form is repeated, and what appears to be an āmreḍita compound results, the resultant form is not an āmreḍita if the members are in a clear relation to each other of subordination. Skt. rāja-rāja-'King of Kings' illustrates this variety.[19] Also independent of the āmreḍita type and differing from it in tone and meaning are those compounds whose stem is repeated in order to strengthen the concept. The type Lat. ipsipse, OHG selbselbo 'his very self' are not considered āmreḍitas. Such compounds are equated with the type Ved. maha-mahás 'very great' in which the accent, being on the second member, is atypical of the pure āmreḍita. Also, the meaning of these three forms, a kind of intensive or superlative, is not the characteristic meaning of the āmreḍita, which is iterative or distributive.[20] Outside of the few variant examples mentioned, this type does not seem to occur in Germanic.

Under the larger classification of bahuvrīhi, or exocentric compounds, we have the type called by the Hindu grammarians dvigu or, the numerative type of compound. These are compounds whose first member is a numeral, which numeral determines the member that follows. The name given to this type by the Hindu grammarians is illustrative of the class: dvigu means 'of, or worth two cows'. Compounds consisting entirely of numerals are not reckoned dvigu but dvandva compounds since, in such compounds, the relation is not one of subordination but of coordination. The Sanskrit words for '11,12,13,etc.', viz. ékādaça-, dvádaça-, tráyodaça-, are coordinate combinations of one and ten, two and ten, three and ten, etc. The Germanic numerals, after the simple roots in one to ten, are likewise dvandva compounds, not dvigu. In Gothic we find attested fidwortaíhun (four and ten) and fimftaíhun (five and ten). The cardinals for eleven and twelve are peculiarly formed in Germanic, however. Go. ainlif and twalif are composed of the roots for one and two plus, as suffix, a form derived from the Gothic stem *leiban, found in the verb bileiban 'to remain'. The etymological sense, then, of the numerals eleven and twelve is (with ten assumed) one, two remaining or, left over. This irregularity is paralleled in Lithuanian, except that in Lithuanian

the cardinals from eleven through nineteen are formed in this way.

In the dvigu proper, not only are the elements in a subordinate relation one to the other, but they partake of the quality common to all exocentric compounds, i.e. the meaning of such a compound is not resolved simply by combining the meanings of the members. The unit meaning is a complex containing a notion additional to the meanings of the members. This additional meaning, in the case of the dvigu, is usually collective or abstractive and is accompanied by the substantivization of the compound as a whole, usually as a neuter.[21] Thus Skt. triyugá- means not simply 'three lives' but 'the time of three lifetimes'; daçāṅgulá- means, not 'ten fingers' but 'the breadth of ten fingers'; similarly Lat. biduum has the meaning 'space of two days'.

In Germanic, dvigu is common, being, however, almost always adjectival in form. OHG einmuoti 'of one mind, unanimous' and einaugi 'one-eyed, blear-eyed' show -ja stem derivations from muot and auga. The same is true of Go. taihuntewjam (dat. pl.) 'ten-rowed', a -ja stem derivative from tewa 'order'. In these Germanic compounds the -ja suffix expresses the collective or abstractive notions which, in the Sanskrit dvigu, are expressed without a derivative suffix. Despite its frequency in other Germanic languages, in Gothic we find only a small number of dvigu compounds: áinfalþs with the meaning 'one-fold, simple', fidurfalþs 'four-fold', fidurdōgs 'space of four days', hundafaþs 'centurion', þusundifaþs 'leader of a thousand men', and a few more.

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1. An earlier version of this paper was read at the tenth University of Kentucky Foreign Language Conference (April, 1957). James W. Marchand has read this paper and made some valuable comments.
2. C. T. Carr, Nominal Compounds in Germanic St. Andrews University Publications No. XLI 43 (London, 1939).
3. Carr 44
4. Cf. Fr. Kluge, Vorgeschichte der Altgermanischen Dialekte[2] 472 (Strassburg, 1906).
5. Cf. A. Meillet, Caractères généraux des Langues German-

iques[7] 218 (Paris, 1949).

6. J. Wackernagel, Altindische Grammatik II 1, 149-50 (Göttingen, 1905).
7. K. Brugmann, Grundriss. II 1, 85-86 (Strassburg, 1889).
8. Kluge 475
9. Carr 40-41 and 40 ft. 1.
10. Carr 41.
11. Carr 41 ft. 1.
12. Fr. Kluge, Urgermanisch[3] 232 (Strassburg, 1913).
13. Carr 42; cf. also T. Storch, Angelsächsische Nominal-composita [8] (Strassburg, 1886).
14. Wackernagel 142.
15. H. Collitz, Ueber eine besondere Art vedischer Composita, Verh. des Fünften Internat. Orientalisten-Congresses 289 (Berlin, 1882).
16. Collitz 288-89; Wackernagel 143.
17. Wackernagel 148.
18. Cf. Brugmann 90; this is apparently an onomatopoetic word of Indo-European origin: cf. H. Hirt, Indogermanische Grammatik IV 4 where several cognates are listed. This form must further be disallowed as an āmreḍita since it repeats only an uninflected syllable. It is perhaps more a reduplication than a repetition.
19. Wackernagel 148
20. Cf. M. Niedermann, Notes D' Etymologie Latine, Mélanges linguistiques offerts à M. Antoine Meillet 111 (Paris, 1902).
21. W. D Whitney, Sanskrit Grammar[2] 512 (Cambridge Mass., 1950).

DISCRIMINATIVE PERCEPTION OF SPEECH SOUNDS AS A FUNCTION OF NATIVE LANGUAGE[1]

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The work of many phoneticians and acousticians has concerned itself with the physical and acoustical determinants of speech perception under normal and noise conditions. In almost all of these studies, the variables under scrutiny have been primarily acoustic. In contrast to this approach, the major objective of the present study has been an attempt to assess the effects of perceptual habits conditioned by native language on the discrimination of actual or potentially meaningful sound contrasts, by presenting the same stimulus materials to speakers of different languages.

The questions broached in the study are: 1.) Are there significant differences between speakers of different languages in the perception and discrimination of partially or totally alien speech sounds? 2.) What differences, if any, will appear in the discrimination of the allophones or conditional variants found in the subject's native language? 3.) If differences are found, will there be indications of systematic error tendency, such as might permit prediction of direction and magnitude of perceptual error in the speaker of a given language in a given language in a given language situation?

Procedure and Materials

Subjects were presented, via tape-recorder and loudspeaker, with a set of stimulus materials consisting, in each item, of a constructed key "word," followed after a seven second interval, by four choice "words." One of these choice "words" is identical with the key "word," the remaining three being essentially the same except for one phonetic element, the "crucial."[2] Position of the correct choice "word" was randomized throughout the items. Subjects were required to indicate which of the four choice "words" matched the key "word."

These "words" which served as carriers of the crucial sounds to be distinguished are nonsense syllables constructed of vowel, consonant and stress patterns derived from prototypes in English, French, Spanish, Portuguese, Italian and

Russian. Similarly, the crucial sound contrasts are derived from phonemic and allophonic levels of these languages, although as inevitable consequence, actual, or close approximations of sounds from other languages appear in either the stimulus sounds or response choices. The carrier "word" was different for each item, an attempt to permit discriminations to take place under an approximation of linguistic verisimilitude. Subjects were permitted to believe that the carriers were actual words in languages unknown to them.

Table I gives the crucial stimulus consonant sounds at the left, and the crucial sounds in choices for response, as column headings. Table II provides the same information for the vowel sounds. A total of 25 scoreable items and 2 practice items were recorded by the first author, and administered to three groups of subjects. The first group consisted of 68 Japanese submariners who had begun a course in English at a United States submarine base, to enable them to take advanced training in submarine operation.[3] These subjects, all male, had no knowledge of English, requiring the instructions for the test to be given in Japanese. The second group consisted of 40 freshmen, of both sexes, enrolled in a first English course at The Ohio State University. All of these subjects reported English as their native and only language. The third group consisted of 12 Latin American graduate students of both sexes, enrolled at The Ohio State University. The native language of all these subjects is Spanish, and their knowledge of English is limited. All but one are enrolled in a course in English for foreigners. Instructions to this group were given in Spanish.

Results

Administration of the materials yielded 25 response scores for each subject, showing which of the four choice "words" he had selected as matching the key "word." A variety of analyses were applied to the data, testing a series of null hypotheses.

First, each item in each group was tested for randomness of response choice by a Chi-Square test of probability. In the responses of the Japanese subjects the hypothesis of random response was rejected at the 1% level of confidence or better in 24 of the items, and at the 5% level in the remaining item.

In the responses of the English-speaking subjects, the hypothesis of random response was rejected at better than 1% level in 24 of the items, and accepted for responses to one item, namely when the stimulus sound was the open back vowel [ɒ]

In the responses of the Spanish-speaking subjects, the hypothesis of random response was rejected in 18 of the items, 14 at the 1% level or better, and 4 at the 5% level. The 7 items in which the hypothesis of chance response was accepted were those presenting the following stimuli:

dental fricative [ð]
bilabial fricative [β]
prepalatal fricative [ʒ]
multiple vibrant [r̄]
closed front [e]
open front [ɛ]
closed back [o]

Table III indicates which items demonstrated determinate responses, and the significance level found for each item. It should be emphasized that the significance measures here are not based on correctness of choice, but indicate a meaningful selectivity of response with regard to the choices.

After identifying the stimuli which elicited significant responses, a Chi-Square test was done for significance of differences in group response on each item. Table IV shows which stimulus sounds yielded significant differences in response between the three groups, and reveals that responses of the Japanese and English-speaking groups were significantly different in 12 items, responses of English and Spanish-speaking subjects were significantly different in 17 items, and responses of Japanese and Spanish-speaking subjects were significantly different in 12 items.

Pausing for a moment to review the results of these analyses, we note that in almost all cases, the perceptual responses of the subjects in the three language groups are purposive, and not random, and further, that in from one half to two thirds of the items these responses are significantly different in the three language groups. While these findings can be taken as

useful and suggestive in general terms, a final examination of the data was undertaken in the form of an item analysis of the nature of these perceptual differences.

Table I (consonants), and Table II (vowels) display the distributions of incorrect responses to all the stimulus sounds. We note, for example, on Table 1, that when the stimulus sound presented in the key "word" was the velar occlusive [g] , unaspirated and fortis, perception as a palatalized occlusive [g'] occurred in 7% of the Japanese subjects, 33% of the Spanish-speaking subjects, and not at all in the English-speaking subjects. Percent frequency of perceptions as fricative and geminate are seen in the next two columns. By summing the percent error, we can derive the percent score of accurate identification in each group, and we note for this stimulus sound 88% accuracy for the Japanese group, 50% accuracy for the Spanish-speaking group, and 92% accuracy for the English-speaking group.

We shall first review briefly the material in Tables I and II, and then examine them for consistencies, patterns and dimensional characteristics.

Examining the distribution of choices for the Japanese responses to stimulus vowels, we find that when the stimulus vowel is closed, and the possible choices extend along a dimension of closed-open-ness, Japanese subjects demonstrate a tendency to error in the direction of an open vowel and/or a diphthong in which the stressed element is open. Nasality is apparently well recognized as a dimension of vocality.

Responses of English-speaking subjects to vowel stimuli are more varied. The highest degree of error in English-speaking subjects occurs in the perception of the open and closed varieties of middle-high front [e] , with the probabilities of confusion in these two sounds being almost equal. Nasality is not well recognized, and error is high in choice of non-nasalized sounds.

In responses of Spanish-speaking subjects we note that the closed high front tense vowel [i] is discriminated with 100% accuracy, but that in the stimulus sounds closed and open [e] ,

and closed and open [o] , where the criterion for discrimination is degree of closure, confusion ranges from considerable to complete.

While all the consonant response distributions are available in the Tables, several examples are of particular interest.

In the item in which the stimulus presented is velar occlusive [g] , unaspirated and fortis, striking differences are noted in both the types and magnitude of error in the three language groups. English-speaking subjects perceived the sound accurately with a score of 92%, and Japanese with 88% accuracy, while the Spanish-speaking subjects show an error of 50%, falling primarily in the palatalized [g'] and also in the geminate.

Of unusual interest is the distribution of choices when the stimulus is the voiced dental fricative [đ] . Examination of the possible choices reveals that all are fricatives, but vary along dimensions of either voicing or place of articulation. Spanish responses are random; Japanese response is highly selective and overwhelmingly in the choice of the surd cognate. English error is also very large, with some error in perception of voicing, but the bulk of the error is in terms of place of articulation.

Similarly we observe when the stimulus is the geminate affricate [ĝĝ] , the error differences are in terms of direction rather than magnitude. Spanish-speaking subjects demonstrate a selection of an [nĝ] cluster, where Japanese and English-speaking subjects do not, while error in English-speaking subjects is exclusively in the choice of the shortened counter-part of the stimulus, [ĝ] .

In an attempt to detect patterns of systematic perceptual error on an atomic level, all responses to consonant stimuli were analyzed wherever possible, along the following dimensions: manner of articulation, place of articulation, voicing, length, and aspiration.

Analysis in terms of <u>manner of articulation</u> reveals that when the stimulus is a stop consonant, all choices of Spanish-

speaking subjects were stops, whereas Japanese and English-speaking subjects showed a small, but consistent error in perception as a fricative. When the stimulus was a fricative, all Spanish choices were fricatives except for confusion between bilabial occlusive and fricative [b͡] . Japanese and English-speaking subjects showed confusion between the bilabial fricative and occlusive [b͡] , and between palatal fricatives and affricates. When the stimulus is an affricate, responses in all groups were affricates. When the stimulus is a flap, there is no error in terms of manner of articulation.

Analysis in terms of place of articulation reveals very little error, and that small quantity tends to be similar in direction and magnitude for all groups.

Analysis along the dimension of voicing reveals a striking error, in Japanese subjects' perceptions of [d̥] as its voiceless counterpart, in contrast to the absence of this type of error in Spanish and English-speaking subjects.

Where length or duration (in terms of simple or geminate) is the criterion, we note that errors in perception of this aspect of duration are rare in Japanese and Spanish-speaking subjects, but are fairly frequent in English-speaking subjects.

Ability to discriminate the presence or absence of aspiration in the stop consonants appears directly gradated, with Spanish-speakers' perception significantly better than that of the Japanese, which in turn is significantly better than that of English-speaking subjects.

Discussion and Conclusions

Limitations in the number of subjects and languages employed, and the technique of administration of the experimental material suggest interpretation of the experiment primarily from the viewpoint of qualitative, rather than quantitative conclusions. Four conclusions seem clear:

1) There are significant differences between speakers of Japanese, English and Spanish in the perception and discrimination of given sounds.

2) The probability of perception of a given sound in a giv-

en environment is related to the language of the listener.

3) Where errors in perception occur, the direction and magnitude of many errors are systematically related to the language spoken by the listener.

4) There would seem to be a good likelihood of predicting direction and magnitude of perceptual confusion, given the stimulus sound and the language of the listener.

The delineation of patterns of confusion, or perceptual error, has been attempted in recent studies by Miller and Nicely (3) and Moser and Dreher (5), and the present study would seem to confirm some of the findings presented by these investigators.[4]

Of much potential value, in the opinion of the authors, is the information derived from the examination of the specific errors associated with given stimulus sounds and conditions. These can be briefly treated in terms of several suggestive notions provoked by the present experiment.

1) Do the relative significance of acoustic cues to perception vary with the language of the listener? We note, for example, that there are significant differences in the perception of the stop consonants /t/, /g/ and /b/ between the three language groups. This may imply that formant transitions in the following vowel may contribute differentially to the identification of the stop consonants in each of the languages.

2) Support is added to the notion, already advanced, that linguistic dimensions other than acoustic constitute an important variable in speech perception.[5] We observe, for example, that when the perceptual task involves discrimination between sounds that are in allophonic distribution in the subject's language, inter-allophone confusion is high; when the sounds involved are phonemically opposed, confusion is smaller. There is a further implication that specific articulation features of a given language can systematically influence perception. Japanese subjects' difficulty in accurate distinction between closed and open vowels seems to be in accord with the observation of Japanese phoneticians regarding the regular open quality of the Japanese vowels. (1, 2, 4)

3) A question is raised regarding the existence of perceptual awareness of the allophonic constituents of a phoneme.

The randomness of response in the Spanish group in many stimulus sounds involving discrimination of sounds in allophonic distribution in Spanish, suggests that the dimensions of variability of these sounds may not have been meaningful to these subjects. Similar, though not as consistent results are found for the English and Japanese groups.

4) There is raised a question of principle regarding the risk in the common practice of generalizing to human language behavior, findings obtained from studies with a mono-lingual bias.

In the study by Miller and Nicely, already cited, we find an evaluation of the relative contributions to intelligibility of several phonetic dimensions, with one of the findings being that discriminations on a dimension of voicing are good. The authors refer only to English consonants and English-speaking subjects, and their conclusions are restricted to these parameters.[6] The findings of the present study are in accord with those of Miller and Nicely with regard to English, but are in contrast regarding perception of this dimension by speakers of Japanese. There would seem to be, in this instance, danger in the common practice of making unverified cross-linguistic generalizations.[7]

In conclusion, the authors believe that further variations in design, and subsequent replication of the experimental approach presented in this paper are necessary, especially in the light of the implications raised for applicability of such findings to problems in international communications procedure, and problems in foreign language teaching and learning.

An important potential application of studies of the present nature lies in the realm of historical phonetics, where perceptual confusions are assumed by some to have systematically directed the phonological development of languages super-imposed on a linguistically different sub-stratum.

As a body of data becomes available concerning the specific effects of given types of linguistic conditioning on the perception of alien speech sounds, it should be possible to predict problem areas going from one known language to another, and it should, conversely, be possible to confirm with greater ac-

curacy our notions of the phonetic structure of one language by observing the perpetual and phonetic confusions its speakers evidence in the acquisition of another language.

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1. Portions of this study were presented as a paper before the Experimental Phonetics Section of the Modern Language Association meetings held in Chicago in December, 1955.
2. The question naturally arises as to whether only the "crucial" element varies in the four stimulus carriers, and whether the subjects are responding to other variations in the stimuli that were not auditorily apparent to the investigators. Sound-spectrograms were made from the tape-recordings presented to the subjects, and close concordance was found between the non-crucial phonetic elements in terms of duration, voicing, and other relevant phonetic dimensions.
3. Test materials were presented to the Japanese subjects by Russell Davis and Maurice Tatsuoka, as part of a battery of experimental language aptitude tests being developed by the authors.
4. An early contribution by E. Polivanov, (6) used an interesting, though less controllable method for studying perception. By asking Japanese subjects to repeat certain foreign words, and noting the errors made, he offers confirming evidence about the phonology of Japanese with particular reference to the structure of the syllable.
5. Cf. for example S. M. Sapon and E. V. Saul, "Findings on the Differential Resistance to Noise of French, Spanish and English", Monograph No. 6, Georgetown Univ. Monograph Series on Languages and Linguistics, pp. 61-70, in which the concept of "differential information load per phoneme" is considered as a factor in perception under difficult conditions.
6. Reference to the cited study by Moser and Dreher reveals that in an investigation of perceptual confusions in a military alphabet, subjects with 20 different native languages were apparently considered as a common population for the analysis of confusion trends. The results of the present study would point to the unreliability of untested assumptions of homogeneity.
7. This discrepancy enhances the importance of non-acoustic

TABLE I

PERCEPTION -- PER CENT FREQUENCY OF ERROR

	g'	~~g~~	gg	b	b'	b	bb	mb	d	v
g	J-7 S-33 E-0	J-4 S-0 E-8	J-1 S-17 E-0							
b				J-28 S-33 E-30					J-21 S-0 E-13	J-16 S-8 E-0
bb					J-0 S-17 E-0	J-0 S-0 E-8		J-31 S-25 E-10		

	v	f	∅	s	∅	n	n'	ŋ	11	1'	l
d	J-1 S--* E-47	J-2 S-- E-20			J-71 S-- E-5						
f			J-22 S-25 E-30	J-3 S-0 E-0	J-2 S-8 E-13						
						J-2	J-0	J-6			

STIMULUS SOUNDS - CONSONANTS

f			S-25 E-30	S-0 E-0	S-8 E-13						
nn						J-2 S-8 E-27	J-0 S-0 E-0	J-6 S-17 E-17			
l									J-1 S-0 E-0	J-0 S-8 E-0	J-2 S-17 E-0

	k	k'	X	h	t	t'	t^h	tt	tS	S	$\hat{z}$	$d\hat{z}$
X	J-6 S-0 E-0	J-0 S-8 E-0		J-21 S-25 E-13								
t						J-2 S-0 E-0	J-19 S-33 E-15	J-20 S-8 E-20				
t^h					J-0 S-17 E-47	J-12 S-0 E-5		J-25 S-8 E-15				
$\hat{z}$									J-12 S-- E-13	J-9 S-- E-7		J-18 S-- E-13

	tS	S	$\hat{z}$	$d\hat{z}$	StS	stS	$\hat{g}$	$n\hat{g}$	$\bar{r}$	r	d
StS	J-9 S-25 E-30	J-0 S-8 E-1				J-66 S-58 E-45					
$\hat{g}\hat{g}$			J-4 S-8 E-0				J-9 S-0 E-20	J-4 S-25 E-0			
$\bar{r}$									J-1 S-- E-0	J-16 S-- E-15	J-53 S-- E-23

J---Japanese subjects
E---English subjects
S --- Spanish subjects
* --- non-significant distribution

						J-16 S--* E-5				J-4 S--* E-0	J-21 S--* E-17	
						J-44 S-17 E--*			J-0 S-0 E--*		J-16 S-0 E--*	
J-9 S-0 E-0			J-1 S-0 E-0					J-7 S-0 E-0				
				J-22 S-25 E-23				J-0 S-25 E-12				J-0 S-0 E-0

* --- non-significant

TABLE II

PERCEPTION -- PER CENT FREQUENCY OF ERROR

i	ɐ	ɐi	ɛ	ae	ju	ɔ:	ʌ	a	o	ɒ	ɒu	ã
J-13 S-0 E-0	J-2 S-0 E-0	J-34 S-0 E-0										
J-22 S--* E-0		J-2 S--* E-0	J-41 S--* E-52									
	J-31 S--* E-25	J-25 S--* E-20		J-4 S--* E-0								
J-27 S-17 E-0	J-18 S-25 E-30				J-6 S-0 E-0							
J-2 S-0 E-5						J-1 S-0 E-0	J-1 S-0 E-5					
						J-16 S--* E-5				J-4 S--* E-0	J-21 S--* E-17	

STIMULUS SOUNDS - VOWELS

i
ɐ
ɐ
y
œ
o

TABLE III

SIGNIFICANCE OF DISTRIBUTION WITHIN ITEM

	A Japanese	B English	C Spanish
i	**	**	**
e	**	**	0
ę	**	**	0
y	*	**	**
oe	**	**	0
o	**	**	**
ǫ	**	0	**
ɑ	**	**	**
ɑ	**	**	**

TABLE IV

SIGNIFICANCE OF DIFFERENCES BETWEEN RESPONSES OF GROUPS

	AB	BC	AC
i	**	**	**
e	0	**	0
ę	*	*	0
y	**	**	0
oe	0	0	0
o	**	**	**
ǫ	0	**	**
ɑ	**	0	**
ɑ	**	**	**

STIMULUS SOUNDS

ʕ	**	0	**	*	**	**
ɖ	**	**	**	**	0	**
æ̃	**	**	*	*	**	**
g	**	**	*	0	**	**
ɓ	**	**	*	**	**	**
bb	**	**	**	0	**	0
d	**	**	0	0	**	0
f	**	**	**	0	0	**
nn	**	**	**	**	**	**
l	**	**	**	0	**	**
X	**	**	**	0	**	0
t	**	**	*	*	0	0
th	**	**	**	**	**	**
ẑ	**	**	0	*	0	0
StS	**	**	**	0	**	0
ĝĝ	**	**	**	0	0	**
r̂	**	**	0	**	**	0

0 P .05
* P .05
** P .01

contributions to perception, inasmuch as voicing is phonemic in English and is positionally variable at times in Japanese.

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STIMULUS WORD	CHOICE "WORDS"				
*1.	mę́na	mę́na	mǫ́na	mí̯na	mú̯na
*2.	papérta	papélta	papésta	papérta	papénta
3.	nága	nág'a	nága	nága	nágga
4.	krǫ́ĉa	krǫ́ĉa	krǫu̯ĉa	krúĉa	krǫ́ĉa
5.	prǫ́StSin	prǫ́Sin	prǫ́tSin	prǫ́stSin	prǫ́StSin
6.	meladés	melaΘés	melavés	meladés	melafés
7.	párama	párama	párama	pá̯rama	pádama
8.	pýsa	písa	pę́sa	pýsa	pjúsa
9.	latažú	laTaSú	latadžú	lataĉú	latažú
10.	tónna	tóna	tónna	tóŋa	tóña
11.	tepę́sa	tepę́sa	tepę̯́isa	tepí̯sa	tepę́sa
12.	fílloga	fíloga	fílloga	fíloga	fílloga
13.	defmés	defmás	defmés	defmés	defmás
14.	táxarun	táharun	tákarun	ták'arun	táxarun
15.	pǫ́limu	pílimu	pǫ́limu	pɔ́limu	pʌ́limu
16.	katémo	kattémo	kat'émo	katémo	katʰémo
17.	tárnebi	tárnebi	tárnebi	tárnevi	tárnedi
18.	morígga	morída	morígga	morínga	morígga
19.	sepátʰa	sepátta	sepáta	sepátʰa	sepát'a
20.	lifóra	liΘóra	lifóra	liɒ́ɔra	lisóra
21.	pintra	péntra	pintra	pę́intra	pintra
22.	tarómba	taróba	tarób'a	tarómba	tarómba
23.	bi̯ltra	bi̯ltra	bi̯ltra	bę̯ltra	báltra
24.	pilabó	pilabó	pilavó	pilabó	pilaðó
25.	rinǫ́ma	rinǫ́ma	rinǫú̯ma	rinɔ́ma	rinǫ́ma
26.	krę́go	kraę́go	krę́go	krę́go	krę̯́go
27.	brǫ́fa	brɔ́fa	brǫ́fa	brǫ́fa	brǫú̯fa

*sample items

The underlined choice word in each item is a duplicate of the stimulus word and represents the "correct" choice.

SIEVERS' LAW AND A RULE OF INDO-EUROPEAN SYLLABLE FORMATION[1]

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The importance of the study of syllable formation in the Indo-European languages has long been realized. In almost all branches of Indo-European, numerous changes can be traced directly to practices of syllable formation, and necessitate statements of the rules of syllable division, etc. for earlier stages of those languages. But, though we possess thorough studies of these practices at the attested stages of almost all the daughter languages, very little is known about the syllable formation of IE itself.

The classical treatments of IE, works such as those of Brugmann and Hirt, contain no section on syllabification, and the syllable is mentioned by them only in passing, if at all, in their discussion of IE. Even Meillet's treatment, in his section entitled "La syllabe", is cursory and uncertain.[2] The first study which purported to be in any way thorough was that of Hermann in 1923.[3] Hermann treated the attested languages quite extensively, but came to no definite conclusions concerning the syllabification of IE, though he seems to have thought that all bipartite clusters were broken. Since Hermann's book, the only investigation of any size is that of Kuryłowicz, published in 1948.[4]

Under such conditions, it goes without saying that much has been assumed which will not bear up under close scrutiny, and that opinions are widely at variance. This is especially true of the situation of obstruent + resonant (= /y w r l m n/).[5] It is maintained by some that such clusters were always divided in the proto-language,[6] by others that they were never divided,[7] and by still others that they were now divided, now undivided, this being governed by conditions we can no longer clearly formulate.[8] The reason for this confusion lies, in my opinion, in the nature of the problem itself. We can determine the syllabification of a proto-language only by observing the reflexes of this syllabification at a later stage of the language. But syllable

formation is very changeable; e.g. what we reconstruct from Greek reflexes of earlier syllable formation applies only for pre-Greek, we cannot assume it without further evidence for IE. So long as we take each individual language as the point of departure, the decision as to the type of syllable formation in IE will have to be based to a great extent on the languages one wishes to stress in his reconstruction. What is actually needed is a glottogonic reconstruction, as Hirt calls it, an internal reconstruction from IE itself. Thus we approach the syllabification of IE from two directions, as it were, and our two types of evidence should complement one another.

The theories as to the origin of the phenomenon known as Sievers' Law are not less diverse. Hermann considers Sievers' Law to have arisen from the effect of allegro and lento forms;[9] Hirt considers the engendering force to be the IE accent;[10] Sievers himself sees in it a "rhythmic law" of the proto-language, somewhat like iambic shortening in Latin.[11] Various Germanic scholars have considered the possibility that Sievers' Law represents the effect of a type of syllable formation in IE,[12] but no one has been able to state clearly the conditions, if indeed it is the result of practices of syllabification. It is the purpose of this paper to attempt an explanation of the origin of Sievers' Law, and at the same time to determine if possible the practices of syllable division in IE with regard to the sequence obstruent + resonant, by attempting to connect the two phenomena.

The Theory

According to F. P. Edgerton's formulation of Sievers' Law, which has found general acceptance among Indo-European scholars, the distribution of the IE resonants, excluding the position of contiguous resonants, was as follows:

tit	ṛit		ti ṛ	
aya	ṛya		ay ṛ	
ayt				
ắtya		ktiya	ā̆tiya	ṛtiya[13]

I would change this to read as follows:

CR̥C	ꟾR̥C	CR̥ꟾ
VRV	ꟾR̥V	VR̥ꟾ
V̆RC		
V̆CRV	CC̥RV V̄C̥RV	ꟾC̥RV[14]

That is to say: A resonant is vocalic between obstruents and between pause and obstruent; a resonant is consonantal between vowels, vowel and pause, vowel and obstruent. Between obstruent and vowel, a resonant is consonantal if the preceding syllable is short (that is, if the obstruent is preceded by a short vowel); if the preceding syllable is long (that is, if the obstruent is preceded by a long vowel or another obstruent), or after pause, the resonant appears as vowel (schwa secundum) + consonant. We illustrate this by the following forms from Gothic:

a. ă̆tya (V̆CRV) - formula: hafjiþ 'lifts' IE *kapyeti.
b. ātiya (V̄C̥RV) -formula: sokeiþ 'seeks' P. Gmc. *sōkiyid-/þi IE *sāg̥yeti.
c. ktiya (CC̥RV) -formula: not attested in Gothic, cf. Lat farcīs, IE *bhark̥yesi.
d. ꟾtiya (ꟾC̥RV) - formula: kijans 'germinated' (past participle) P. Gmc. *kiyanaz, IE *g̥yonos.

It is important to note here that pause has the same effect as a long syllable.[15]

I would suggest the following process as the origin of such forms as *g̥yono- (ꟾC̥RV):[16] In the past participle forms of Germanic, we expect the reflex of the IE zero grade: that is, in the case of the verbs of the 4th ablauting class, ꟾCRV, e.g. *gyono-. The IE *g̥yono-, of which Gothic kijan- is the reflex, must have arisen because of the fact that the cluster CRV was not admissible in initial position, "was hard to pronounce". Such a sequence representing an intolerable complex in the language, an anaptyctic vowel, the so-called schwa secundum, developed between C and R, either as a new development, or as a weakening of a full-grade vowel, yielding C̥RV. Whether one accepts this explanation or not, the fact remains that, wherever we expect the zero grade in the case of initial clusters of CRV, we find C̥RV. We have thus our first rule of syllable formation.

The sequence of obstruent + following tautosyllabic ante-

vocalic resonant was not tolerated in IE after pause, i.e. in utterance initial syllables. Wherever such a cluster is is to be expected according to the rules of ablaut, etc., we find rather a schwa secundum inserted between obstruent and resonant. Instead of **Ɂtya (ɁCRV), we find *Ɂtiya (ɁCəRV).[17]

It has long been recognized that there is a connection between the treatment of word-initial and syllable-initial clusters, since word-initial clusters are explosive (syllable-initial) by definition.[18] It was noted above that pause, long vowel and vowel + consonant have the same effect on a following antevocalic resonant, i.e. that pause and long syllable have the same effect. This fact, coupled with the known parallelism between word-initial and syllable-initial tolerances, entitles us to assume the following rule as a working hypothesis: "In IE, a cluster of obstruent + tautosyllabic antevocalic resonant was not tolerated, but was always relieved by the insertion of a schwa secundum." This rule leads to the following: "At a stage of IE prior to the working of Sievers' Law, a cluster of obstruent + antevocalic resonant was divided after a short vowel, but not after a long vowel or another obstruent." This may be explained graphically as follows:

1. **kap|yesi *kap|yesi (cf. Goth. hafjis, Lat. capis), but
2. **sā|gyesi *sā|gəyesi (cf. Goth. sokeis, Lat. -sagīs),
3. **bhar|kyesi *bhar|kəyesi (cf. Lat. farcīs).

That is, syllable-initial **ky and **gy were treated exactly as word-initial **ky and **gy, **|gyesi became *|gəyesi, exactly as **Ɂgyo- became *Ɂgəyo- (cf. Goth. kijan-, IE *gəyono- > **gyono-).

The Evidence

Since we have, within IE itself, only the effect of this type of syllabification, the assumption is not provable except as an explanation of these effects. The treatment of clusters of CRV after a long syllable cannot be investigated with regard to syllable formation, since such clusters do not exist in IE. To demonstrate the validity of the assumption, it would suffice to show that we are justified in reconstructing a syllabification of the type V̆C|RV in IE. That is, if CRV is always broken C|RV

after a short vowel, and if tautosyllabic antevocalic CR is not permitted initially, then the fact that antevocalic CR is not permitted after long vowel or obstruent can only be explained by the assumption that CR was once tautosyllabic after long vowel or obstruent. We must now demonstrate that a syllabification of the type VC|RV actually existed in the proto-language. The discussion is based for the most part on Hermann's work.

Sanskrit. In Sanskrit we have metrical evidence to show that such clusters were always divided after a short vowel. The first syllable of such words as putráḥ 'son' is counted long in the meter, which means that the syllabification was of the type put|ráḥ, not pu|tráḥ (a syllable is long only if it ends in a consonant or a long vowel). Thus in the following pada of the triṣṭubh type: (RV 4.18.11b) ámī tvā | jáhāti pūt|rā dēváḥ 'these gods are avoiding (?) you, son', we see that the syllable division is put|ra.

Greek. We have the same sort of evidence for early Greek. In early Greek poetry, the first syllable of such a complex as VCRV is considered long.[19] Note, for example, the following Homeric line (Iliad 6.446): árnumĕ|nōs pat|rós tĕ mĕ|gā klĕŏ|s ēd' ĕmŏ|n autoũ 'striving for (maintaining ?) my father's glory and my own'. Here we have the syllabification pat|rós and between words, méga k|leos.

Pre-Greek. Morphophonemic alternations within Greek can inform us concerning the syllabivication of Pre-Greek, though not of Greek itself.[20] The alternations may be cited:

Wheeler's Law. According to the rule known as Wheeler's Law (B. J. Wheeler, The Greek Nominal Accent, p. 60 f.), dactylic oxytones (–⏑́) in Attic-Ionic, that is, words accented on the final syllable, with the third from the last syllable being long, became paroxytones (with accent on the penultima), cf. the following forms, which must then have had in Pre-Greek the syllabic structure –⏑⏑: pugmákhos, kunoklópos, patrási, logográphos, as opposed to such forms as khthamalós, stuphelós, glukerós, stibarós, etc., which must have the syllabic form –⏑⏑.

The adjectives in -os. In the comparative and superlative degrees of these adjectives, we find o after a long syllable, ŏ after a short syllable, cf.; leptótatos, kednótatos, ekpaglótatos, makrótatos, peszóteros (sz from *dy) as compared to sophótatos for example.

The evidence offered by these alternations and others,[21] shows that in Pre-Greek, clusters of obstruent + resonant were

divided after short vowels.

Pre-Latin. In Latin itself, the rules of the treatment of consonant + resonant are quite diverse, and cannot be discussed here. Suffice it to say that in the early poetry, such clusters were usually divided after a short vowel, as in the early Greek poetry.[22] The morphophonemics of Latin show that clusters of consonant + resonant were divided in Pre-Latin. A number of examples such as impetro and palpebra show clearly such a syllable division. That is, impetro and palpebra must go back, respectively, to *enpat|ro, *palpeb|ra (?), since in open syllables the *a and *e would have become *i in non-initial syllables, cf. conspicit 'perceives', from *conspe|cit, but conspectus, conficit, but confectus.[23]

Consonant Lengthening. Consonant lengthening or consonant gemination in the IE languages before resonants also offers us evidence of syllabification. The process of gemination before resonants is often misunderstood, and it is still frequently affirmed that the change of e.g. *atya to *attya demonstrates an original syllabification of the type *a|tya. As de Saussure and Kuryłowicz have shown, exactly the opposite is true.[25] In the case of syllabification of the type V|CRV (e.g. a|tya) there is no tendency towards a shift of the syllable border, so long as the cluster CRV is tolerable. If, on the other hand, the second element of a bipartite group is a continuant, i.e. is capable of being syllabic, as in the case of the IE resonants, a syllabification of the type VC|RV will inevitable lead to a syllabification of the type V|CRV or VC|CRV, that is, with the syllable border falling within the obstruent itself, and for the following reason. A single consonant between vowels always belongs to the following syllable.[26] A syllable border consists of implosion+ explosion, with explosion being the more important of the two. A continuant, not having an abrupt onset, cannot be explosive, so that the explosion of the obstruent then forms the syllable initial, there being no other explosion. Phonetically, a syllabification of the type at|ya is not possible without glottis constriction. Structurally speaking, we may explain it in this manner. If the language has syllabification of the following types: 1. a|ta and 2. at|ka, a sequence of the type atya (VCRV) is ambiguous as to syllable formation. If the resonant or continuant is taken to be vocalic, then the syllabification is a|tya; if it is consonantal, then we have at|ya; if it is ambivalent, then we have $a^{t}|tya$ or $at^{\cdot}|ya$. So long as the type at|ta does not exist in the lan-

guage, the inevitable phonetic gemination which follows upon a syllabification of the type at|ya will not be noticed, will not be phonemic. With the arising of geminates from other sources, we expect either a shift in syllable border or a phonemicization of the gemination before resonants. At any rate, wherever we find sporadic (phonetic) gemination before resonants in the IE languages, this points to a syllabification of the type at|ya.

Sanskrit. In Sanskrit, we find substantiation for this rule. Here there is phonetic gemination before resonants, but not phonemic; before resonant, all consonants may appear either as geminates or as simple consonants, we may have either puttráḥ or putráḥ; aggníṣ or agníṣ, sattyáḥ or satyáḥ.[27] According to the grammarians, such words as putráḥ were actually pronounced put-tráḥ, so that in etymologizing, such words as satyáḥ could be considered to be composed of sat + yáḥ, sat + tyaḥ, or sa + tyáḥ (cf. Panini 8, 4, 47, 48, 50-52).

Greek. In ancient Greek, we can cite a number of cases of spontaneous gemination before resonants (examples from Brugmann, I[2], 948): iddiān 'private', pólios 'city' (gen. sg.), Pausannías 'allayer of sorrow' (private name), proksennīān 'treaty of friendship'; allóttrios 'belonging to another' (Gortyna inscription), etc.

Latin. From inscriptions we may cite: SOCCIORVM 'allies' (adj. gen. pl.) (CIL VI, 6874), LATTRONES 'servants' (CIL VIII, 7251), SUPPREMIS (for suprēmus) 'highest' (CIL VIII, 7251), AGGRO 'field' (dat.-abl.) (CIL III, 2448), etc.

Germanic. In West Germanic consonants are lengthened after a short vowel before r, l, m, n, y and w; it is occasionally assumed that this happened also after a long vowel,[28] but in view of the operation of Sievers' Law, consonant + r, l, m, n, y, or w must have been rare in Proto-Germanic after a long syllable.[29] The following examples are taken from Braune-Mitzka, Althochdeutsche Grammatik[8], Tübingen, 1953, §96 and Sievers-Brunner, Altenglische Grammatik[2], Halle, 1951, §§225 ff.:

a. before r: OHG snottar, OE snottor 'clever' (Goth. snutrs*); OHG bittar, OE bitter 'bitter' (cf. Goth. baitrs).

b. before l: OHG aphul, OE æppel (cf. ON epli).

c. before m: no certain cases, but cf. Middle Low German bessem 'broom' (OE besma); OE mapþum beside māþm.

d. before n: OHG rocko, OS roggo 'rye'; OHG backo 'cheek', tropfo 'drop'; OE lappa 'rag'; budda 'bug'; ebba 'ebb-tide'; frogga 'frog' (all n-declension).

e. before y: OHG skephan, OE scieppan, OS skeppian 'create' (Goth. skapjan); OHG setzen, OE settan, OS settian 'to set' (Goth. satjan).

Indo-European. The previous discussion has shown that the earliest stages of at least four languages or language groups, Greek, Latin, Sanskrit, and West Germanic, had a syllable division of the type V̆C|RV. This might be enough to permit us to reconstruct this type of syllable division for IE itself, but still the reconstruction might be open to question, since syllable borders have shifted in historical times in attested languages, and might have shifted in the transition from IE to the various branches. De Saussure, and following him Meillet, have attempted to show that there was, in IE itself, phonetic gemination of obstruents before resonant + vowel.[30] De Saussure discovered in IE a converse of the rule that obstruents are doubled before resonant + vowel in IE, in the fact that double consonants are treated as single before resonant + vowel after short vowel. That is, such a complex as petro in IE may be the result of either pe + tro or pet + tro or pet + ro, just as in the case of the Skt. example cited above. The following examples are cited: **pet-tro 'feather', from the root *pet 'to fly' plus the suffix -tro (used to form names of instruments) >*petro, Gmc. feþrō, ON fjöðr, OHG fedara, OE feder; cf. also Gk. hypopetrídios, -- **sed-tlo, from the root *sed 'to sit' + the suffix tlo, >*setlo, OHG sedal, -- **med-tro- 'measurement', from the root *med + the suffix -tro, >*metro-, cf. Gk. métron, -- **bhid-tro- (root *bhid 'to cut, bite' + suffix -tro) > *bhitro, cf. Gk. phitrós 'chip'. While I do not wish to deny this rule, it should be pointed out that there is evidence to the contrary, that is, evidence of the same simplification after long vowels, where there was no cluster, cf. OHG bīhal 'hatchet', Gmc. *biþola-, IE *bheiṭlo- < **bheid-tlo- (root *bheid 'to cut'), OHG fuotar, Gmc. *fōdora-, IE *pāṭro- < **pāt-tro (root *pāt 'feed, protect'), etc.[31] These forms could be explained by a later analogy to the short forms, but uncertainty still exists. Structural evidence shows asyllabification of the type V̆C|RV for IE also, however. In IE, we have a syllable division of the type V̆|CV and V̆C|CV, a|ta, ak|ta, so that a sequence of V̆CRV is theoretically ambiguous, being V̆|CRV if the R is vocalic, V̆C|RV if it is consonantal. Since the resonant in such complexes is always consonantal, the syllabification is structurally V̆C|RV.

Conclusion

The preceding discussion has shown that we have three types of evidence, all pointing to a syllabification of the type V̆C|RV in IE: the evidence of Greek, Latin, Sanskrit, and West Germanic (comparative evidence); the evidence of the structure of IE (internal evidence); and the evidence of Pre-IE (internal reconstruction). In view of the agreement of all three, this type of syllabification is assumed for IE. Not only does it satisfy the requirements of a good reconstruction in that it can be defended from the standpoint of the evidence of the daughter languages, but also in that it can be adduced to explain as regular developments things which would otherwise appear anomalous. The assumption that such a syllabification type as ā|tya, ak|tya lies at the basis of Sievers' Law is based on this assumption. It is somewhat less certain, since it carries reconstruction back one step further. This explanation of Sievers' Law is to be preferred, however, to any hitherto proposed, in my opinion, and may be stated now as follows:

At an earlier stage of IE an obstruent after a vowel and before a resonant + a vowel was a member of the first syllable (i.e. V̆C|RV); after a long vowel or another obstruent, it was a member of the second syllable (i.e. V̄|CRV, VC|CRV). Since a cluster of the type CRV· was not permitted (as witnessed by the fact that utterance initial CRV > C̥RV), an anaptyctic vowel was inserted between C and R (V̆|C̥RV, VC|C̥RV). In other words, obstruent + antevocalic tautosyllabic resonant was not permitted in IE.[32]

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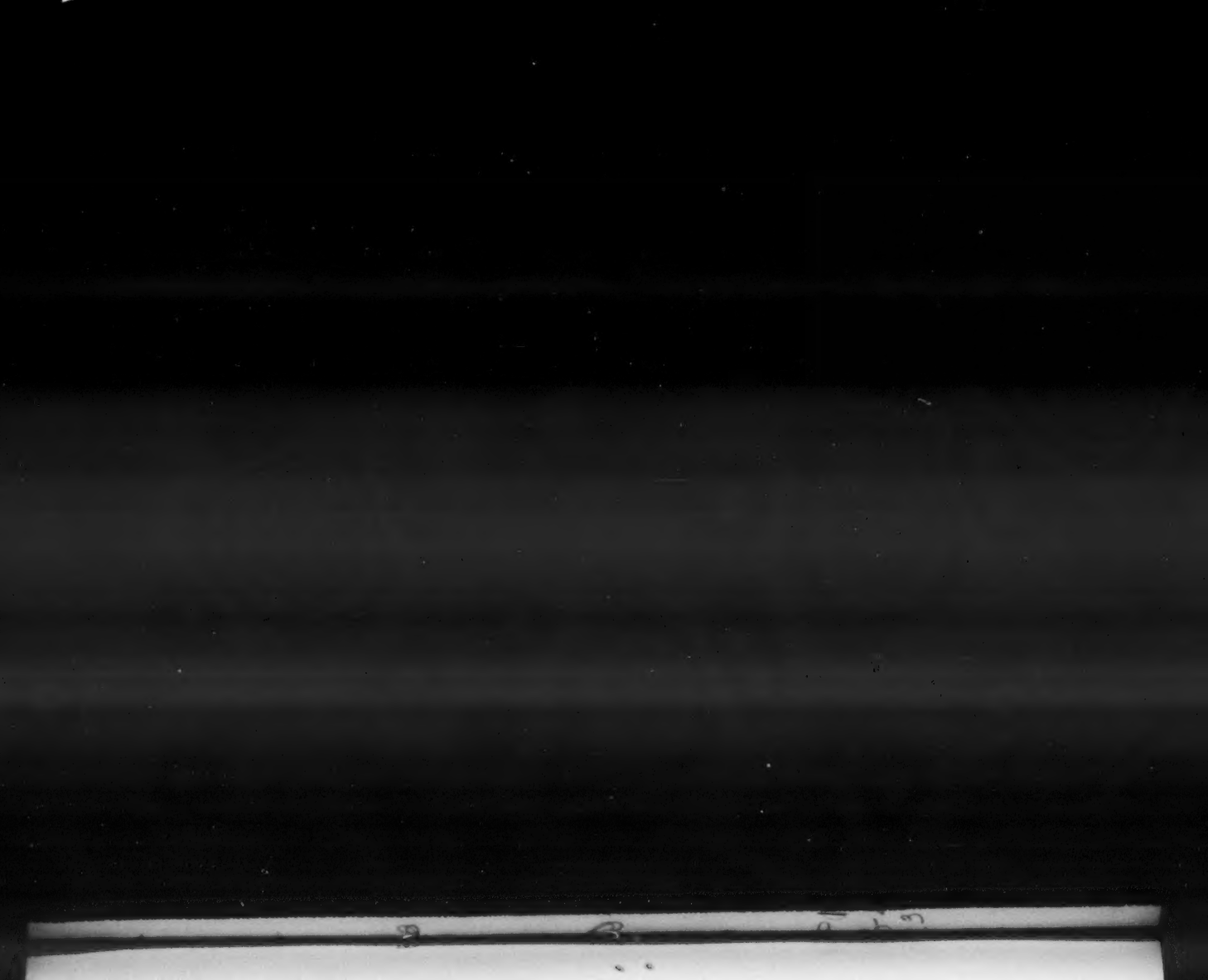
1. A preliminary draft of this paper was presented at the Ann Arbor Summer Meeting of the Linguistic Society of America in 1956. I am indebted for some points of statement to the remarks made there. This paper also owes much to my discussions with Prof. Jerzy Kuryłowicz and Prof. Saul Levin, the latter of whom was kind enough to check my Greek and Sanskrit citations.
2. A. Meillet, Introduction à l'étude comparative des langues indo-européennes[8], Paris, 1938, 126 ff. This does not mean that I disagree in any essential way with the assumptions presented by Meillet and de Saussure; my interpretation is different.

3. Eduard Hermann, Die Silbenbildung im Griechischen und in den anderen idg. Sprachen, Göttingen, 1923; also published as Supplementband III to ZvS.
4. J. Kuryłowicz, "Contribution à la théorie de la syllabe," Bulletin de la Société Polonaise de Linguistique 8 (1948) 80-114.
5. The resonants appear either as consonants, y w r l m n, or as vowels, y̯ w̯ r̥ l̥ m̥ n̥. Please note that, in order to be consistent in the rendering of the consonantal and vocalic allophones of the resonants, I avoid the use of the signs i̯ and u̯, i̯̯ and u̯̯. I would suggest this to others as a much simpler and pedagogicaly more sound means of rendering the resonants.
6. Hermann, p. 351.
7. Hirt, IF 12, 227 f.; Sievers, Pauls Grundriss I[1], 413, PBB 16, 263.
8. F. de Saussure, "Sur un point de la phonétique des consonnes en indo-européen," MSL 6 (1889) 246-257 (opposed by Hermann, p. 357), Meillet, 130 f. Hermann himself seems to waver in his assumption that all bipartite clusters were divided, cf. p. 277. We may mention as a curiosity the opinion of Walde (Die germanischen Auslautsgesetze, Halle, 1900, 160-161), according to which Proto-Gmc. and pre-Gmc. divided, e.g. *sib|ja, but also *dag|es, as well as the opinion of C. A. M. Fennell (Indo-Germanic Sonants and Consonants, Cambridge, 1895, 87 ff.), according to whom IE had a "tendency to keep accented syllables as free as possible from consonantal sound," that is, a tendency towards open syllables, with the restriction that syllables beginning with a vowel must end in a consonant.
9. Hermann, p. 358 f.
10. Hirt, Indogermanische Grammatik, Vol. II, Heidelberg, 1921, p. 198.
11. Sievers, PBB 5, 130-139.
12. Cf. W. van Helten, PBB 16, 281 ff.; von Grienberger, PBB 21, 204. See also Hermann, p. 277.
13. Cf. F. P. Edgerton, "Sievers Law and IE Weak-Grade Vocalism," Language 10 (1934) 235-265; "The Indo-European Semi-Vowels," Language 19 (1943) 83-124. t̯ = any consonant, i̯ = any vocalic resonant, y̯ = any consonantal resonant, ¶ = pause, a̯ = any vowel, ă = any short vowel, k̯ = consonant other than t̯. In spite of occasional criticisms

(Borgstrøm, NTS 15, 152 f.; Kuryłowicz, Etudes indoeuropéennes, 255 f.), no real evidence to contradict Edgerton's formulation of Sievers' Law has ever been found. Even Kuryłowicz seems willing to accept it now, cf. "Théorie de la syllabe," p. 90 f.

14. C = obstruent, R = resonant, $\underset{\cdot}{R}$ = syllabic resonant, V = vowel, ə = schwa secundum. I reconstruct schwa secundum here, against Edgerton, because schwa secundum exists elsewhere in IE, not in the vicinity of resonants (as in Lat quattuor, as compared with Goth. fidwor; Lat. magnus, Goth. mikils, Gk. megas, etc. etc.), and because the reconstruction of such a form as *nmmo- to cover Gothic numans 'taken' would necessitate a whole new set of sound changes to take care of the simplification of expected geminates; *nmmo- should yield *numma- in Gothic. Cf. Sturtevant, Language 19, 294 ff. I intend to treat the question of schwa secundum in another article soon; it is secondary to the present problem.
15. Edgerton, Language 10, 235 f.; Lehmann, Proto-Indo-European Phonology, Austin, 1952, p. 11.
16. I follow here a suggestion by H. Güntert, Indogermanische Ablautprobleme, p. 123.
17. Following my teacher, Herbert Penzl, I use ** to indicate an earlier stage of IE or a stage removed from reality by one more degree, * to indicate the normal reconstruction.
18. Hermann, 79; W. Fr. Twaddell, "A Phonological Analysis of Intervocalic Consonant Clusters in German, "Actes du 4ème Congrès International de Linguistes, Copenhagen, 1938, p. 219 ff.; Kuryłowicz, "Théorie de la syllabe," 81 ff.
19. Cf. A. Meillet and J. Vendryes, Traité de grammaire comparée des langues classiques[2], Paris, 1948, pp. 130-32. This rule is not infallible in Homer, cf. W. R. Hardie, Res metrica, Oxford, 1920, p. 35, where statistics are cited.
20. On this rule, cf. J. W. Marchand, General Linguistics, I, p. 84.
21. Cited by Hermann, pp. 13-113.
22. Meillet-Vendryes, 130-132; L. Havet, MSL 4, 21 ff.
23. F. Sommer, Handbuch der lateinischen Laut- und Formenlehre, 2.3. Aufl., Heidelberg, 1913, §163.2; Meillet-Vendryes, 130-132.
24. For example, W. Brandenstein, Einführung in die Phonetik und Phonologie, Vienna, 1950, p. 63.

25. De Saussure, "Sur un point de la phonétique," 250 ff.; Kuryłowicz, "Théorie de la syllabe," 87 ff.
26. For a defense of this rule, see Kuryłowicz, 83 f.
27. W. Wackernagel, Altindische Grammatik, I, Göttingen, 1896, p. 113, p. 278; W. D. Whitney, Sanskrit Grammarl, §232; de Saussure, p. 252.
28. Braune-Mitzka, p. 93 f.; Sievers-Brunner, p. 204 f.
29. Cf. J. W. Marchand, GL II, p. 61.
30. De Saussure, passim; Meillet, p. 130.
31. Cf. A. Noreen, Urgermanische Lautlehre, Strassburg, 1894, p. 200-201. The simplification of ttr to tr could be merely a common simplification of geminates in IE, like the simplification of ss to s, as in **es-si > *esi (Meillet, 131). A like simplification is found in Latin, also before a svarabhakti: sēdulō < *sēd-dolōd, sēcubō < *sēc-cubō < *sēd-cubō, etc., cf. Meillet-Vendryes, §139.
32. It is my own personal opinion, which I cannot now prove, that no tautosyllabic clusters were permitted before vowel in Indo-European; I shall take up this problem later in an article on schwa secundum.